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PENSOFT

First record of *Selaginella conduplicata* Spring (Selaginellaceae) in the Brazilian Atlantic Forest, Northeastern Brazil

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Abstract

This is the first voucher-based record of *Selaginella conduplicata* Spring in the Brazilian Atlantic Forest and the Brazilian Northeast. This species was considered restricted to the Amazon Basin, and here we report its occurrence beyond the Amazonian limits, expanding its distribution. Illustrations of the diagnostic characters of the species, information of geographic distribution and conservation status are presented. Besides, we present description as well as taxonomic and nomenclatural comments.

Keywords

Amazonia, biogeography, distribution, herbarium.

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Introduction

The genus *Selaginella* P.Beauv. (Selaginellaceae, Lycopodiopsida) is the most diverse among the representatives of lycophytes (Góes-Neto and Salino 2018), with about 700–800 species (Zhou and Zhang 2015; PPG I 2016). In tropical America, they occur mainly in the primary and secondary rain forest, usually found in soils, rocky outcrops and rocky cliffs associated with rivers, streams, and waterfalls (Tryon and Tryon 1982; Góes-Neto 2016).

In Brazil, the genus is more diversified in the Amazon region where occurs 55 native species (Góes-Neto et al. in prep.). In this region, one of the most widespread species is *Selaginella conduplicata* Spring, an articulate species traditionally recognized in the subgenus *Stachygynandrum* ser. *Articulatae* (sensu Walton and Alston 1938) or *Stachygynandrum* (sensu Jermy 1986, 1990), and more recently circumscribed in the subg. *Ericetorum* sect. *Articulatae* (sensu Zhou and Zhang 2015) or subg. *Gymnogynum* (sensu Wetstrand and Korall 2016). In Brazil, this species was considered restricted to Amazon Basin, however, after review of specimens deposited in two herbaria, Herbário Geraldo Mariz, Federal University of Pernambuco (UFP) and Herbário Professor Vasconcelos Sobrinho, Rural Federal University of Pernambuco (PEUFR), we report for the first time the occurrence of *S. conduplicata* in the Atlantic Forest biome and in the Northeastern Brazil.

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In this way, this study aims to contribute to the knowledge about *Selaginella* in Brazil, providing a species description, comments on taxonomy, nomenclature, habitat and conservation, as well as drawings of *S. conduplicata*.

Methods

The new occurrences of the species were found during the analysis of the full collection of *Selaginella* specimens of the herbaria UFP and PEUFR. The acronyms are in accordance with Thiers (2020).

The samples were examined with a stereomicroscope Zeiss Stemi DV4. The descriptive terminology for leaves follows Góes-Neto et al. (2015, 2017), Góes-Neto (2016), and Góes-Neto and Salino (2018). The geographical distribution was based on Smith (1995) and Góes-Neto (2016). For evaluation of the conservation status of *S. conduplicata* we used the IUCN Red List categories and criteria (IUCN 2012).

Results

Selaginella conduplicata Spring, 1840; Flora Brasiliensis 1 (2): 129.

Type locality: Brazil. Pará: *Martius, s.n.* (possibly M, not located).

New records. BRAZIL • 7 specimens; Pernambuco, Caruaru, Brejo dos Cavalos; 08°21′21″S, 036°01′46″W; 22 Feb. 1987; I.C.L. Barros et al. s.n. leg.; UFP 17789. • 2 specimens; Pernambuco, Vicência, Engenho Xixá; caminho da pedra de São José; 07°35′05″S, 035°24′57″W; May 1992; I.C.L. Barros et al. s.n. leg.; PEUFR 31485.

Identification. Plants terrestrial, epipetric or occasionally epiphytes. Stems creeping, decumbent or erect, stramineous, glabrous, conspicuously articulate. Rhizophores dorsal, throughout stem (prostrate specimens) or restricted to stem base (decumbent to erect specimens). Lateral microphylls lanceolate, bases biauriculate, acroscopic auricle usually more developed, overlapping the stem and curving inward, denticulate, basiscopic auricle short, less evident, denticulate, acroscopic margins whitish, sparsely denticulate along proximal ½, serrate to serrulate along distal ½, basiscopic margins narrowly whitish, entire to serrulate near the apices, apices acute, slightly curved, upper surfaces glabrous, smooth, without idioblasts, lower surfaces without idioblasts. Dorsal microphylls ovate-lanceolate, ovate-elliptic to narrowly elliptic, base biauriculate with outer auricle more developed (sometimes the impression is of having only one auricle; Fig. 1C), margins narrowly hyaline, denticulate throughout, upper surfaces without idioblasts, inconspicuous stomata along midrib, apices acuminate. Axillary microphylls ovate-lanceolate, bases biauriculate, with two long denticulate auricles, commonly different in size, margins conspicuously hyaline, denticulate throughout, apices acute. Strobili quadrangular. Sporophylls subdimorphic, deltate-lanceolate, bases biauriculate, apices long-acuminate. Megasporangia single, at base of strobilus. Microsporangia throughout strobilus. Megaspores white, reticulate. Microspores cream to pale beige, papillate.

Distribution and conservation. This species occurs in Brazil, Colombia, Guyana, French Guiana, Peru, Suriname and Venezuela (Smith 1995). In Brazil has a known geographic distribution in the states of Acre, Amapá, Amazonas, Mato Grosso, Pará and Roraima. In addition, it is being reported here for the first time in Pernambuco (Fig. 2). Occurs in rain forests, riparian forests, and grassland vegetation, in the North and Center-West of Brazil, and in "Brejos de Altitude" from Pernambuco state, Northeastern Brazil, between 0–900 m alt.

Selaginella conduplicata is widely distributed in Northern Brazil and it is found in several ecosystems and habitats. This species has large populations, commonly with many mature (fertile) individuals. Therefore, *S. conduplicata* is considered Least Concern (LC) within the International Union for Conservation of Nature's Red List categories and criteria (IUCN 2012).

Discussion

Selaginella conduplicata differs from the other Brazilian articulate species by its lateral microphylls biauriculate with the acroscopic auricle longer than the basiscopic (Fig. 1D), axillary microphylls with two developed denticulate auricles and with denticulate margins especially on acroscopic portion (Fig. 1B). However, according to Góes-Neto et al. (2015) occasionally, both auricles of lateral microphylls are similar in size and shape.

Selaginella conduplicata has great variability in its habit, with individuals with the main stem erect, while others have the stem completely prostrate, sometimes with long proliferous apex.

Spring (1840) erroneously published, in Flora Brasiliensis, *Selaginella stellata* Spring for Brazil. According to Assis (2016), when analyzing the drawings and the description referred to *S. stellata* it is evident that these were based on a creeping form of *S. conduplicata*. In addition, the name *S. stellata* had already been validly published by Spring (though not intentionally) two years earlier in a little-known publication (i.e., Spring 1838), where the type specimen comes from Mexico. For this reason, the publication of *S. stellata* in Flora Brasiliensis (Spring 1840) is a later homonym, and this name should not be applied to Brazilian specimens. For lack of knowledge of the work of Spring (1838), some authors such as Mickel and Beitel (1988) wrongly used the name *S. stellata* for Brazilian specimens, and other authors like Alston (1936) and Tryon and Stolze (1994) erroneously considered S. *conduplicata* as synonymous to *S. stellata*.

Selaginella stellata occurs from Mexico to Panama, whereas *S. conduplicata* is apparently restricted to

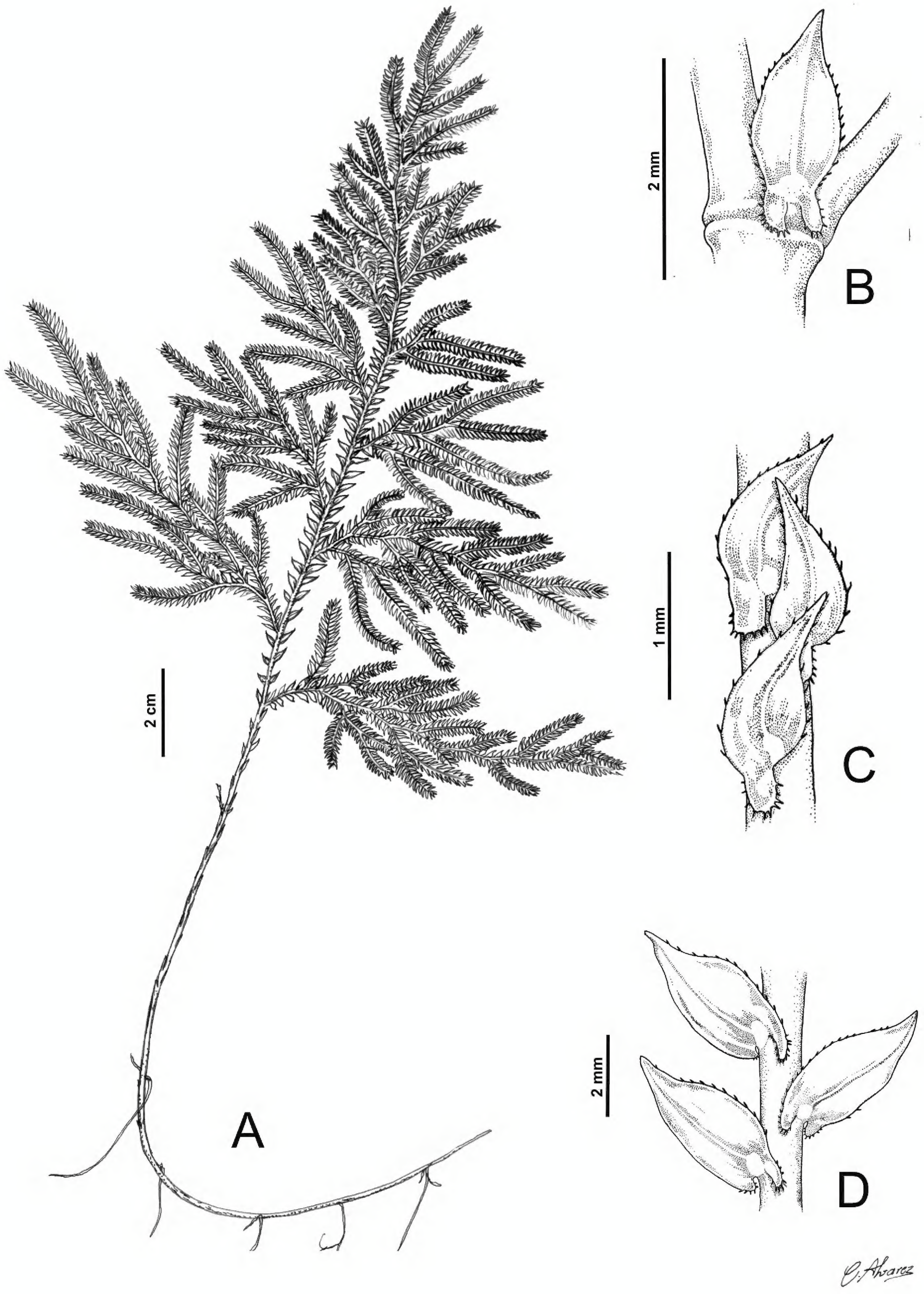

Figure 1. *Selaginella conduplicata*. **A.** Habit. **B.** Lower surface of axillary microphyll. **C.** Upper surface of dorsal microphylls. **D.** Lower surface of lateral microphylls.

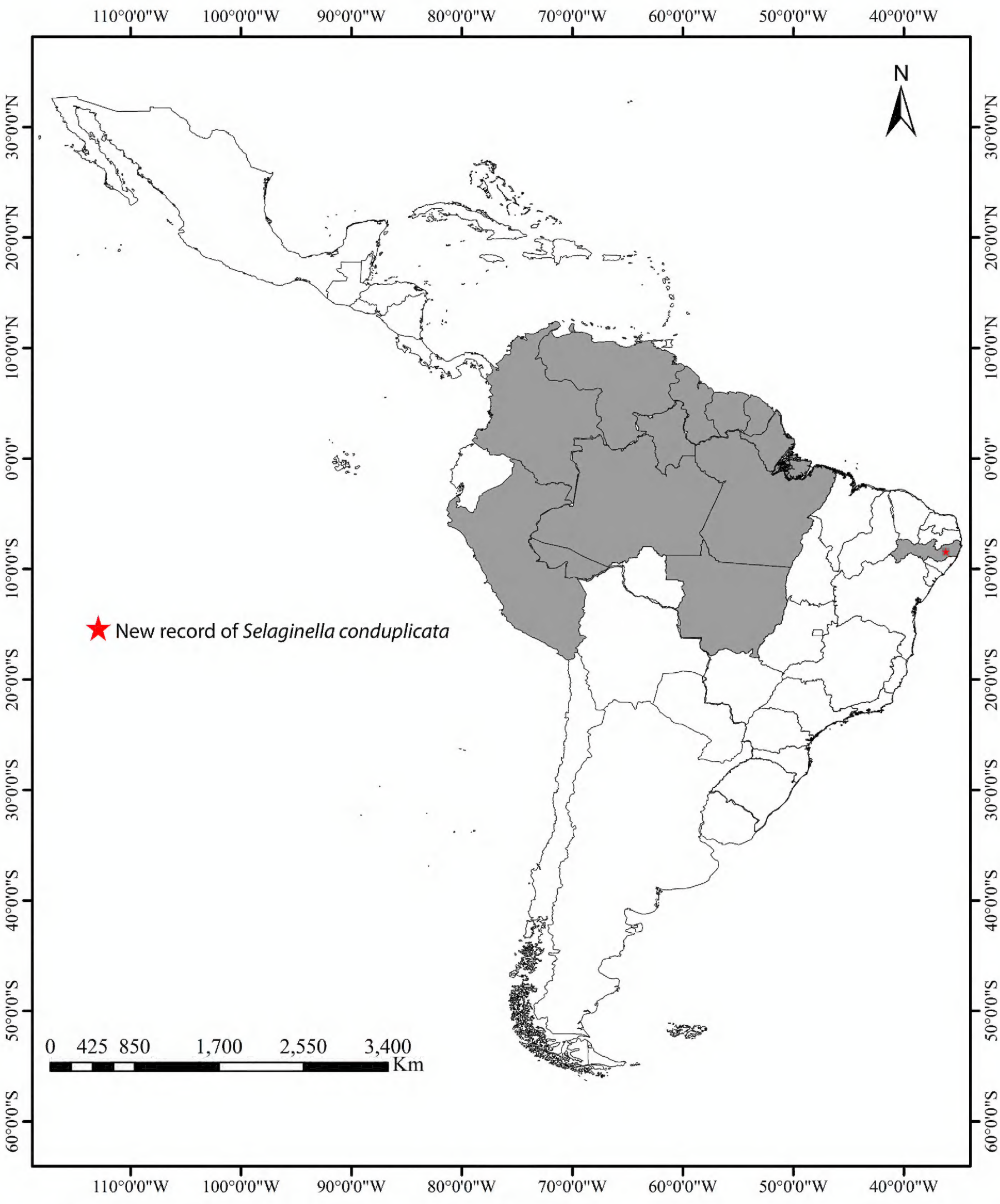

Figure 2. Geographical distribution of *Selaginella conduplicata* in South American countries and in Brazilian states (highlighted in gray). The red star indicates the new record from Pernambuco state, Northeastern Brazil.

South America. *Selaginella conduplicata* differs from *S. stellata* chiefly, by its axillary microphylls with long-auriculate (vs usually truncate to inconspicuously short-auriculate) and denticulate (vs long-ciliate) base, lateral microphylls with acroscopic (vs basiscopic) auricle more developed and denticulate (vs long-ciliate).

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Authors' Contributions

LAAG-N analyzed and identified the species in the herbaria, gathered the data, and wrote the paper. AS revised the manuscript.

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